

**CLAIMS**

1. A plasma surface processing system for processing a surface of a metal material by forming plasma in a reaction chamber, the system comprising  
5 a supply device for plasma processing solution which supplies a processing material which forms plasma into the reaction chamber as a liquid drop form in order to process the surface of the metal material.

2. The system of claim 1, wherein the supply device for plasma  
10 processing solution comprises:  
a processing solution reservoir for storing plasma processing solution  
201 as a hermetic state;  
a carrier gas inflow pipe connected to the reservoir and for introducing carrier gas which carries liquid drops of the plasma processing solution; and  
15 a supply pipe installed by connecting the reservoir and the reaction chamber in order to supply the carrier gas including liquid drops of the plasma processing solution into the reaction chamber.

3. The system of claim 2, wherein the carrier gas inflow pipe is  
20 installed under a state of being soaked in the processing solution stored in the reservoir, and has a plurality of discharge holes for forming processing solution foam by the carrier gas discharged from the inflow pipe.

4. The system of claim 3, wherein an end portion of the carrier gas inflow pipe has a ring shape where the plurality of discharge holes are formed.

5. The system of claim 3 or 4, wherein the carrier gas inflow pipe is  
5 provided with a gas amount controller for controlling amount of carrier gas.

6. The system of claim 2, wherein the carrier gas inflow pipe is provided with a gas amount controller for controlling amount of carrier gas.

10 7. The system of claim 3, 4, or 6, wherein the carrier gas inflow pipe is further provided with a separation pipe connected to the reaction chamber in order to introduce the carrier gas into the reaction chamber.

8. The system of claim 7, wherein gas flow control valves are  
15 respectively installed at the separation pipe and between a connection spot of the inflow pipe and the separation pipe and the reservoir.

9. The system of claim 7, wherein the separation pipe is connected  
to  
20 the supply pipe.

10. The system of claim 2, wherein the carrier gas inflow pipe is further provided with a separation pipe connected to the reaction chamber in

order to introduce the carrier gas into the reaction chamber.

11. The system of one claim of 2, 4, 6, or 10, wherein the supply pipe is further provided with a gas amount controller for controlling amount of the carrier gas including liquid drops of the processing solution.

12. The system of claim 11, wherein a pair of valves for controlling flow of the carrier gas are installed at the supply pipe up and down on the basis of the gas amount controller.

10

13. The system of one claim of 2, 4, 6, or 10, wherein the reservoir is further provided with a temperature control device for controlling temperature of stored processing solution.

15 14. The system of claim 13, wherein the temperature control device comprises:

a receiving tank for receiving the reservoir and in which insulating oil is filled;

a heater installed in the receiving tank and for generating heat; and

20 a cooling device installed in the receiving tank and for absorbing heat.

15. The system of one claim of 2, 4, 6, or 10, wherein the supply pipe is further provided with a heater for increasing temperature of the carrier gas

including liquid drops of the processing solution.

16. The system of claim 1, wherein the surface of the metal material is consecutively processed.

5

17. The system of claim 1, wherein the metal material is an electrode.

18. The system of claim 1, wherein the processing solution is hexamethyldisilazane (HDMS) or hexamethyldisiloxane (HDMSO).

10

19. The system of claim 1, wherein the carrier gas is  $N_2$  or He.

20. The system of claim 1 or 2, wherein the reservoir further comprises a processing solution supplementary device for supplementing plasma processing solution thereinto.

15

21. The system of claim 20, wherein the processing solution supplementary device comprises:

a first supplementary pipe connected to the reservoir;

20 a storage container in which processing solution is stored;

a second supplementary pipe connected to the storage container;

a connecting unit for connecting the first supplementary pipe and the second supplementary pipe; and

valves respectively installed at the first and second supplementary pipes.

22. In a plasma surface processing system for processing a surface of a metal material by forming plasma in a reaction chamber, a supply device for plasma processing solution which supplies a processing material which forms plasma into the reaction chamber as a liquid drop form in order to process the surface of the metal material.